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THE EFFECTORS OF SEA-ANEMONES

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Sea-anemones, like other animals, have special sets of organs, effectors, by which they respond to changes in the environment. In these animals there are at least four sets of such organs: the mucous glands, the nematocysts, the cilia, and the muscles.

The mucous glands are unicellular glands found on almost all surfaces of the body and concerned partly in protecting the surface against insult and partly in rendering it sticky whereby the animal as a whole adheres to a rock or other fixed object or foreign bodies adhere to the animal as in the collection of food by the tentacles.

The nematocysts are the well-known organs of defense and offense. They are most numerous and best developed on the tentacles and on the acontia. By their abundant discharge large animals may be stung and driven away and small ones killed and appropriated for food.

Cilia are means of generating currents and of transporting small bodies over surfaces and through tubes. They are best developed on the tentacles, the acontia, and the oesophagus. The oesophageal cilia ordinarily beat outward, but in the presence of food they reverse temporarily and beat inward thus carrying the food into the digestive cavity.

The mucous glands, the nematocysts, and the cilia have all been supposed to be under nervous influence. In all cases their action in reference to the stimulus appears to be strictly local; that is, they become active only over the exact region stimulated. Moreover if sea-anemones are subjected to anesthetics, such as chloretone, or magnesium sulphate, their nervous activitites can be completely abolished but without interfering in the least with the secretion of mucus, the activity of nematocysts or of cilia including their reversal. For these reasons it is concluded that the three types of effectors just mentioned are independent of nervous control and respond to direct stimulation.

Muscles on the other hand are commonly under the influence of nerves, an influence that disappears entirely when the sea-anemone is fully anesthetized. Some muscles, however, such as the longitudinal muscles of the acontia, have been shown to be independent effectors. They are slow in response often requiring a minute or more between the time of stimulation and that of contraction, and are not influenced by ordinary anesthetics.

The majority of the muscles in a sea-anemone respond quickly under the influence of the nerve-net and enter into a state of enduring contraction (tonicity). This is as characteristic of a small fragment of an animal, provided it contains a nerve-net as well as muscle, as it is of a whole animal. So striking is this excessive tonicity in the muscle of sea-anemones that it has been assumed to be their exclusive function and they have recently been regarded (Jordan) as animals incapable of ordinary reflexes. Such a conclusion, however, seems to be too sweeping.

If a specimen of Metridium is allowed to expand fully and a small piece of meat is placed on its tentacles, the mouth and oesophagus soon open and the sides of the column are marked by a few pronounced vertical grooves. After the food has been swallowed the grooves disappear and the oesophagus closes. The opening of the oesophagus is brought about by the contraction of the transverse muscles of the mesenteries whose action is so precisely associated with the appropriate stimulation of the tentacles that it carries with it all the signs of a reflex. It therefore seems clear that among the muscles in sea-anemones there are not only independent effectors, and tonus muscles associated with nerve-nets, but neuromuscular combinations that exhibit true reflex action.

The detailed paper will be published in the *Journal of Experimental Zoology*.

PRELIMINARY EVIDENCE OF INTERNAL MOTION IN THE SPIRAL NEBULA MESSIER 101

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Inasmuch as data for the proper motions of stars, determined by photographic methods, have been rapidly accumulating since the beginning of the century, it may seem strange that the first results for nebulae should have been published only in 1915. It must not be forgotten, however, that photographs of nebulae require much longer exposures, and that, even with the best plates, the measures are more difficult and less accurate, because of the unsymmetrical character of the points and condensations upon which settings must be made, than is the case with the round images of stars. A given point in a nebula may be bisected quite differently on different plates and the measures